

## CLIP

### CROSS REFERENCE TO OTHER APPLICATIONS

[0001] The present application is a continuation of pending International patent application PCT/US02/30659 filed on September 26, 2002 which designates the United States, and which claims priority of Japanese patent application 2001-301829, filed September 28, 2001.

### FIELD OF THE INVENTION

[0002] The present invention relates to a clip usable for fastening a plurality of plate members including a component such as an ornamental component of automobiles, industrial machines or the like, and a panel such as an automobile body. In particular, the present invention relates to a clip capable of completing a fastening operation of a plurality of plate members with occupying less space in the backside of the plate members, and providing a good appearance of the backside after the fastening operation.

### BACKGROUND OF THE INVENTION

[0003] Heretofore, a component such as an ornamental component has been fixed to a panel such as a body panel of an automobile by a clip made of synthetic resin. Such a conventional clip includes a two-piece clip comprising a clip body and a pin, an anchor-leg type clip, and a two-piece, sandwiching type clip.

[0004] Figs. 11A to 11C show examples of the conventional clips.

**[0005]** The two-piece clip as shown in Fig. 11A comprises a clip body including a flange and a leg portion provided on the lower surface of the flange, and a pin including a head and a shank provided on the lower surface of the head. After forming a mounting hole in each of a plate component and a plate member to be fastened, and superimposing the plate component on the plate member while aligning their mounting holes with one another, the leg portion of the clip body is inserted into the aligned mounting holes, and then the shank of the pin is pressed into the leg portion to expand the end of the leg portion, so that the plate component and the plate member are sandwiched and fastened between the lower surface of the flange of the clip body and the expanded end of the leg portion.

**[0006]** The anchor-leg type clip as shown in Fig. 11B comprises a flange and an anchor leg integrally formed with the flange. After the anchor leg of the clip is inserted into the respective mounting holes of the plate component and the plate member, the anchor leg is expanded, so that the plate component and the plate member are sandwiched and fastened between the lower surface of the flange and the expanded anchor leg.

**[0007]** In the above conventional two-piece clip, it is required to protrude a certain length of the leg portion from the backside of the plate member because the fasteness is assured by expanding the end of the leg portion by the shank of the pin. The conventional anchor-leg type clip also requires a certain length of the anchor leg protruding from the backside of the plate member because the fasteness is assured by the expansion of the anchor leg.

**[0008]** In the conventional clips, the flange located on the frontside or obverse side is generally finished to provide a flat surface in consideration of an exterior appearance. However, in the region where the clip protrudes from the backside of the plate member to be fastened, it has been required to assure a given space for allowing a certain length of the leg to be protruded from the backside. And an appearance of the region was not considered important because the region can not be seen.

**[0009]** While the conventional two-piece, sandwiching type clip allows the space in the backside to be reduced, it is required to handle the clip from both the frontside and backside of the plate member.

**[0010]** In view of the above problems, it is therefore an object of the present invention to provide a clip capable of completing a fastening operation from one side of plate members, occupying less space in the backside of the plate members, and providing a good appearance of the backside after the fastening operation.

#### SUMMARY OF THE INVENTION

**[0011]** In order to fasten a plurality of plate members with a clip, the lower portion of the clip should have an outer diameter smaller than the inner diameter of respective mounting holes of the plate members, and after passing through the mounting holes, the outer diameter of the lower portion of the clip should become larger than the inner diameter of the mounting holes of the plate members.

**[0012]** The present invention provides a clip for fastening a plurality of plate members, comprises a bush and a pin to be inserted into the bush.

**[0013]** The pin includes a flange, a shank extending downward from the lower surface of the flange, and an enlarged portion at the lower end of the shank.

**[0014]** The bush includes a ring portion having a step for receiving the flange therein, a holding portion provided on the downside of the periphery of the ring portion, a pair of opposed legs inclining inwardly and provided on the downside of the ring portion and on the inside of the holding portion. The bush further includes a pair of retaining portions each provided on the lower end of the corresponding leg.

**[0015]** In an assembled state after the pin and the bush are assembled by inserting the enlarged portion of the pin into the bush, the pair of legs of the bush are adapted to maintain the inward inclining.

**[0016]** In a pushed-in state after the pin is fully pushed into the bush, the legs and the retaining portions are adapted to be moved outward by the enlarged portion of the pin so as to allow the plate members to be fastened between the lower surface of the holding portion of the bush and the respective upper surfaces of the retaining portions.

**[0017]** Further, in the pushed-in state, the lower surface of the enlarged portion of the pin is adapted to be substantially coplanar with the respective lower surfaces of the retaining portions of the bush.

**[0018]** In one embodiment of the present invention, in the pushed-in state, the lower surface of the enlarged portion and the respective lower surfaces of the retaining portions may be adapted to form a continuous flat (flush) surface thereacross. This continuous flat surface may have an oval shape.

**[0019]** In another embodiment of the present invention, the pin and the bush may be provided with engagement means for allowing the pin and the bush to be engaged with one another so as to be held in the respective assembled and pushed-in states. The engagement means may be a combination of a groove formed in the pin and an engagement pawl provided in the bush.

**[0020]** In still another embodiment of the present invention, each of the legs of the bush may be provided with a rib.

**[0021]** In yet another embodiment of the present invention, the ring portion of the bush may be provided with a detaching groove for detaching the pin from the bush in the pushed-in state.

**[0022]** In the clip of the present invention comprising two parts consisting of the pin and the bush, the pin and the bush are assembled by inserting the shank and enlarged portion of the pin into the bush, and then the assembled pin and bush are inserted into aligned mounting holes of the plate members to be fastened. Then, the pin is forcedly pushed into the bush to expand or outward move the legs and retaining portions of the bush by the enlarged portion of the shank, so that the plate members are sandwiched and securely fastened between the lower surface of the holding portion and the respective upper surfaces of the retaining portions of the bush.

**[0023]** In the pushed-in state or the state after the plate members are fastened with the clip, a continuous flat surface or a continuous flush surface is formed by three surfaces consisting of the two lower surfaces of the retaining portions of the bush and the lower surface of the enlarged portion at the end of the shank of the pin.

This provides a good appearance of the backside of the plate members, and allows the space for attaching in the backside to be reduced.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Fig. 1A is a side view of a pin according to an embodiment of the present invention.

[0025] Fig. 1B is a top view of the pin.

[0026] Fig. 1C is a sectional view of the pin taken along the line C-C of Fig. 1B.

[0027] Fig. 1D is a side view of the pin.

[0028] Fig. 1E is a bottom view of the pin.

[0029] Fig. 2A is a side view of a bush according to an embodiment of the present invention.

[0030] Fig. 2B is a top view of the bush.

[0031] Fig. 2C is a sectional view of the bush.

[0032] Fig. 2D is a sectional view of the bush taken along the line A-A of Fig. 2B.

[0033] Fig. 2E is a sectional view of a rib of the bush.

[0034] Fig. 3 is a top view of the pin and the bush in an assembled state.

[0035] Fig. 4 is a fragmentary sectional view of the pin and the bush in the assembled state.

[0036] Fig. 5 is a sectional view of the pin and the bush in the assembled state taken along the line B-B of Fig. 3.

**[0037]** Fig. 6A is a perspective view of the pin and the bush in the assembled state, when seeing from the frontside thereof.

**[0038]** Fig. 6B is a perspective view of the pin and the bush in the assembled state, when seeing from the backside thereof.

**[0039]** Fig. 6C is a perspective view of the pin and the bush in the pushed-in state, when seeing from the frontside thereof.

**[0040]** Fig. 6D is a perspective view of the pin and the bush in the pushed-in state, when seeing from the backside thereof.

**[0041]** Fig. 7 is a fragmentary sectional view showing the state before a clip is inserted into mounting holes.

**[0042]** Fig. 8 is a fragmentary sectional view showing the state after the clip is inserted into the mounting holes.

**[0043]** Fig. 9 is a fragmentary sectional view showing a fastened state after the pin is fully inserted into the bush.

**[0044]** Fig. 10 is a fragmentary sectional view showing the state when the pin is detached from the bush.

**[0045]** Fig. 11A is an explanatory view of one conventional clip.

**[0046]** Fig. 11B is an explanatory view of another conventional clip.

**[0047]** Fig. 11C is an explanatory view of still another conventional clip.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0048]** With reference to the drawings, an embodiment of the present invention will now be described.

**[0049]** Fig. 1A is a side view of a pin 10 of a clip according to the embodiment of the present invention, Fig. 1B is a top view of the pin, Fig. 1C being a sectional view of the pin taken along the line C-C of Fig. 1B, Fig. 1D is a side view of the pin, and Fig. 1E is a bottom view of the pin. A circular disk-shaped flange 11 is formed at one of the ends of the pin 10. The flange 11 has an outer diameter allowing the flange to be fitted into a step of a ring portion 21 of a bush 20 described later in detail. The flange 11 has a substantially flat upper surface. The flange 11 is provided with a shank 12 extending vertically downward from the lower surface of the flange. As shown in Fig. 1B, the shank 12 has a substantially I-shaped cross section. The shank 12 is formed with a pair of grooves 17 adjacent to an after-mentioned enlarged portion 15, and another pair of grooves 18 adjacent to the flange 11. The respective pairs of the grooves 17, 18 are adapted to receive therein a pair of after-mentioned engagement pawls 29 of the bush 20 when the pin 10 is inserted into the bush 20.

**[0050]** The shank 12 is provided with the enlarged portion 15 at the other end thereof. The enlarged portion 15 has a substantially flat lower surface defined by surrounding with a pair of opposed straight lines 15a, 15b and a pair of opposed curved lines 15c, 15d. When the pin 10 is forcedly pushed into the bush 20, the region defined by the pair of straight lines is pushed forward while moving legs 25 (described below) of the bush 20 outward. The outer diameter of the pair of curved lines 15c, 15d is arranged to conform with the inner diameter of mounting holes of a plurality of plate members to be fastened.

**[0051]** Fig. 2A is a side view of the bush 20 of the clip according to the embodiment of the present invention, Fig. 2B is a top view of the bush, Fig. 2C being a



sectional view of the bush, Fig. 2D is a sectional view of the bush taken along the line A-A of Fig. 2B, and Fig. 1E is a sectional view of a rib of the bush. The bush 20 includes the ring portion 21 at the upper portion thereof, and the upper surface of the ring portion 21 is formed with the step for receiving therein the flange 11 of the pin 10. The ring portion 21 is partially lowered in height to define a detaching groove 22 for allowing a flat-head screwdriver to be inserted therethrough after fastening the plate members with the pin 10 and bush 20 so as to detach the pin 10 and the bush 20 from the plate members.

[0052] The ring portion 21 is also formed with a pair of opposed holding portions 23 on the downside of the periphery thereof. The inner edges of the lower surfaces of the holding portions define an inner diameter larger than the inner diameter of the mounting holes of the plate members to be fastened. Thus, the lower surfaces of the holding portions are brought into contact with the upper surface of the uppermost plate member on the outside of the mounting hole thereof. In order to assist the holding portions 23, a pair of auxiliary holding portions 24 are provided on the downside of the ring portion along the direction perpendicular to the opposed holding portions 23.

[0053] As shown in Fig. 2C, the bush 20 includes a pair of legs 25 each provided on the downside of the ring portion 21 and on the inside of the corresponding holding portion 23, the legs 25 are inclining inwardly. When the pin 10 is forcedly pushed into the bush 20, the legs 25 are expanded or moved outward by the enlarged portion 15 of the pin 10.

[0054] As shown in Fig. 2D taken along the line A-A of Fig. 2B, the bush 20 also includes the pair of engagement pawls 29 adjacent to the respective auxiliary

holding portions 24. Each of the engagement pawls 29 is engaged with the corresponding groove 17 to temporarily fixed the pin 10 to the bush 20 in an assembled state after the pin 10 and the bush 20 are assembled by inserting the pin 10 into the bush 20, and then engaged with the corresponding groove 18 to fixed the pin 10 to the bush 20 on a permanent basis in a pushed-in state after the pin 10 is fully pushed into the bush 20.

[0055] As shown in Fig. 2E, each of the legs 25 is formed with a rib 26. In a fastened state after the plate members are fastened with the clip by fully pushing the pin 10 into the bush 20, each of the outer peripheries of the legs 25 should be in contact with the respective inner surfaces of the mounting holes of the plate members. If each of the legs 25 is designed to bring its entire outer periphery into contact with the inner surfaces of the mounting holes, a load required for deforming the legs will be increased. For this reason, the thickness  $h1$  of each of the ribs 26 is set to conform with the inner diameter of the mounting holes, and each of the legs is designed to have a thickness  $h2$  less than the thickness  $h1$ .

[0056] Each of the legs 25 is formed with the retaining portion 27 at the other end thereof. The distance between the respective outermost points of the retaining portions 27 is less than the inner diameter  $D1$  of the mounting holes of the plate members because the legs 25 are inclining inwardly. Thus, the retaining portions 27 can pass through the mounting holes before the fastened state.

[0057] The enlarged portion 15 of the pin 10 expands the legs 25 of the bush 20 by forcedly pushing the pin 10 into the bush 20. Thus, the legs 25 are brought into contact with the inner surfaces of the mounting holes, and the respective upper

surfaced of the retaining portions are brought into contact with the lower surface of the lowermost plate member on the outside of the mounting hole thereof.

**[0058]** With reference to Figs. 3 to 5, the assembled state is explained after the pin 10 and the bush 20 are assembled. Fig. 3 is a top view of the pin 10 and the bush 20 in the assembled state. Fig. 4 is a sectional view of the pin and the bush in the assembled state. The term "upper" herein means the upper side in Fig. 4.

**[0059]** Fig. 5 is a sectional view of the pin and the bush in the assembled state taken along the line B-B of Fig. 3. In Fig. 5, a position L1 of the pin and the bush in the assembled state is shown by a solid line, a position L2 of the pin and the bush in the pushed-in state is shown by a two-dot chain line.

**[0060]** In the assembled state after the pin 10 and the bush 20 are assembled (or at the position L1), each of the engagement pawl 29 of the bush 20 is engaged with the corresponding groove 15 of the pin 10 to assure the engagement between the pin 10 and the bush 20 so as to maintain the assembled state. In the pushed-in state after the pin 10 is fully pushed into the bush 20 (or at the position L2), the pin 10 is located at the position shown by the two-dot chain line, each of the engagement pawls 29 is engaged with the corresponding groove 18 to assure the engagement between the pin 10 and the bush 20 so as to maintain the fastened state. In the pushed-in state or the fasten state, the upper surface of the flange 11 is substantially flat with the upper surface of the ring portion 21.

**[0061]** With reference to Figs. 6A to 6D, the assembled state is explained after the pin 10 and the bush 20 are assembled, and the pushed-in state after the pin 10 is fully pushed into the bush 20 will further be described in detail.

**[0062]** Fig. 6A is a perspective view showing the pin 10 and the bush 20 in the assembled state before the pin is forcibly pushed into the bush, when seeing from the frontside thereof, and Fig. 6B is a perspective view showing the pin 10 and the bush 20 in the assembled state, when seeing from the backside thereof. Fig. 6C is a perspective view showing the pin and the bush in the pushed-in state after the pin is fully pushed into the bush, when seeing from the frontside thereof, and Fig. 6D is a perspective view showing the pin and the bush in the pushed-in state, when seeing from the backside thereof. In these figures, the pin 10 is shown by two-dot chain lines.

**[0063]** In the assembled state after the pin 10 and the bush 20 are assembled and before the pin 10 is forcibly pushed into the bush 20, the retaining portions 27 are disposed adjacent to one another, as shown in Fig. 6B.

**[0064]** In the pushed-in state after the pin is fully pushed into the bush, the flange 11 of the pin 10 is fitted into the step formed in the upper surface of the ring portion 21 of the bush 20, as shown in Fig. 6C. Each of the straight lines 15a, 15b of the enlarged portion 15 of the pin 10 is in contact with the inner edge of the lower surface of the corresponding retaining portion 27 of the bush 20, and a continuous curved line is formed by the curved lines 15c, 15d of the enlarged portion and the respective outer edges of the lower surfaces of the retaining portions. Further, the lower surface of the enlarged portion 15 of the pin 10 is substantially flat with the respective lower surfaces of the retaining portions 27 of the bush 20, and these lower surfaces form a continuous flat surface having an oval shape.

**[0065]** With reference to Figs. 7, 8 and 9, an operation for assembling the pin 10 and the bush 20 and then fastening a pair of plate members (panels) P1 and P2 will

be described below. For example, the plate member P1 is an automobile body, and the plate member P2 is an ornamental component. As shown in Fig. 7, the pin 10 and the bush 20 are assembled into a clip by inserting the pin 10 into the bush 20 from above with directing the enlarged portion downward.

[0066] Then, a mounting hole 31 of the plate member P1 is aligned with a mounting hole 32 of the plate member P2, and the assembled clip is inserted into the aligned mounting holes 31, 32 in the direction shown by the arrow, with directing the retaining portions downward. In this operation, the retaining portions 27 can pass through the mounting holes because the maximum diameter of the retaining portions 27 or the distance between the respective outermost points of the retaining portions 27 is less than the inner diameter D1 of the mounting holes.

[0067] Fig. 8 shows the state after the clip is inserted into the mounting holes. The holding portions 23 are in contact with the upper surface of the plate member P2 to prevent the downward movement of the clip. In this state, the retaining portions 27 have passed through the mounting holes, and lies at a position lower than the lower surface of the plate member P1.

[0068] Then, as shown in Fig. 9, the pin 10 is forcedly pushed into the bush 20. In this operation, the enlarged portion 15 of the pin 10 is pushed forward while expanding or outward moving the legs 25 of the bush 25. When the lower surface of the flange 11 of the pin 10 is brought into contact with the step of the ring portion 21 of the bush 20, the pin 10 is stopped. In this state, the ribs 26 of the legs 25 are in contact with the inner surfaces of the mounting holes of the plate members P1, P2.

**[0069]** The plate members P1, P2 are sandwiched and securely fastened between the lower surfaces of the holding portions 23 of the bush 20 and the upper surfaces of the retaining portions 27. In this state, the lower surface of the enlarged portion 15 of the pin 10 is substantially flat with the respective lower surfaces of the retaining portions 27 of the bush 20. Three surfaces consisting of the lower surface of the enlarged portion 15 and the two lower surfaces of the retaining portions 27 are combined to form a continuous flat surface having an oval shape. This provides a good appearance of the backside of the plate member P1, and allows the attachment space in the backside to be reduced.

**[0070]** An operation for detaching the clip in the fastened state will be described below.

**[0071]** Referring to Fig. 9, the ring portion 21 of the bush 20 is partially lowered in height to define the detaching groove 22. The engagement between the engagement pawls 29 and the grooves 18 are released by inserting a screwdriver 40 between the upper surface of a part of the holding portions and the lower surface of the flange 11 and forcedly separating the pin 10 from the bush 10. Even if the above engagement is released, the legs 25 and the retaining portions 27 do not occasionally return to their original configurations before the fastened state due to ageing, and thereby the retaining portions 27 are still in contact with the lower surface of the plate member P1. In this case, the clip can be readily detached by forcedly pulling up the clip.

**[0072]** When the detached clip is reused, the clip may be inserting into the mounting holes with pinching the retaining portions 27 with fingers or the like to fasten

the plate members again. In this manner, the clip according to this embodiment can be readily reused.

**[0073]** As described above, according to the present invention, after fastening the plate members with the clip, the lower surface of the clip forms a continuous flat surface. Thus, as compared to conventional clips, the clip can complete a fastening operation on one side of the plate members, and occupying less space in the backside of the plate members, and providing a good appearance of the backside after the fastened.